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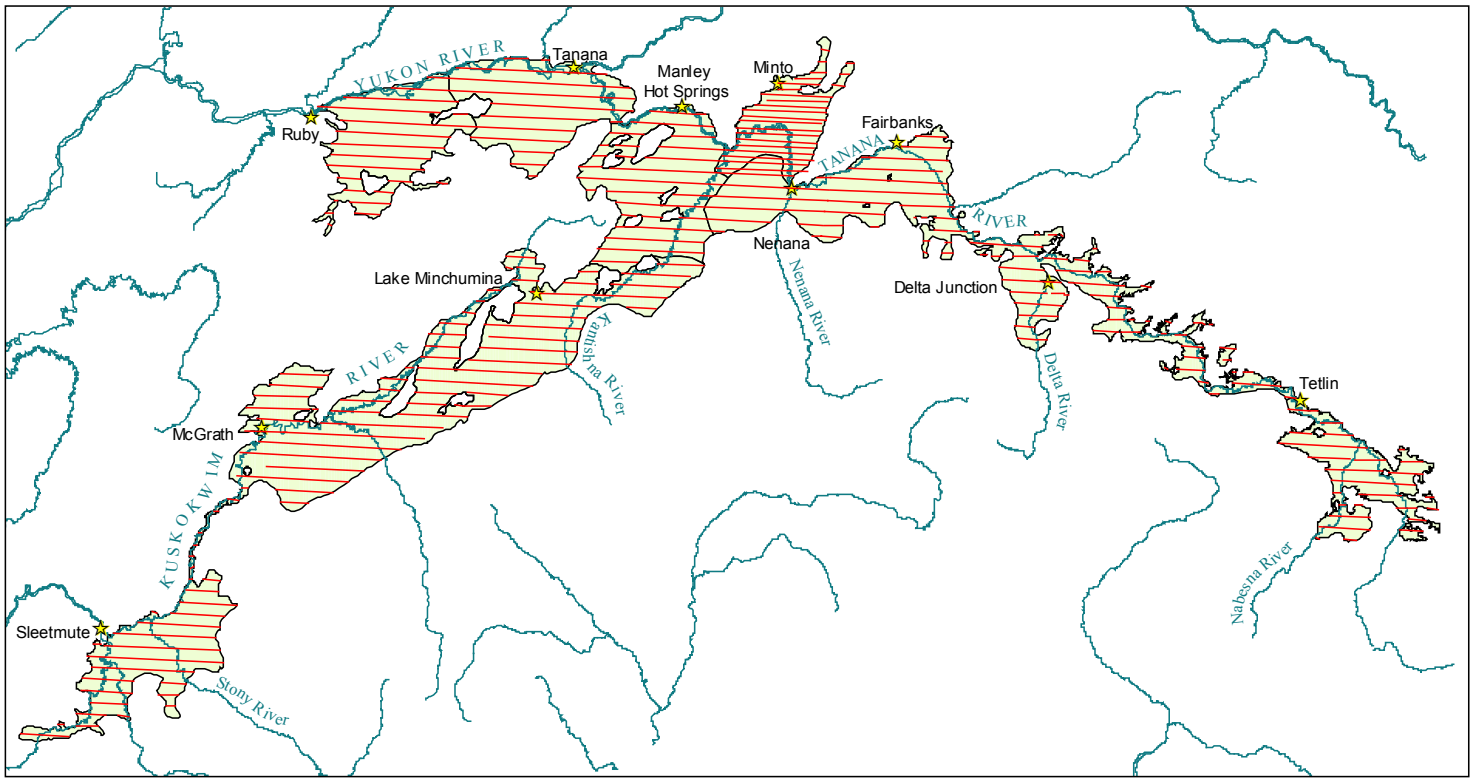

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WATERBIRD ABUNDANCE AND DISTRIBUTION ON THE TANANA/KUSKOKWIM LOWLANDS, ALASKA, 2001-2002

by

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January, 2003

Key words: abundance, aerial surveys, Alaska, density, distribution, estimates, geographic information system, indices, Kuskokwim, mapping, population, Tanana, waterbirds, waterfowl

EXECUTIVE SUMMARY

Surveys were flown to estimate abundance and map distribution of waterbirds in May 2001 and 2002 on the Tanana River and Kuskokwim River lowlands. An estimated average 345,908 ducks, 4,098 geese, and 2,019 loons were present on the survey area. Northern pintails were the most numerous ducks comprising 18% of the duck population. The four next most abundant species in descending order were green-winged teal, scaup, American wigeon, and mallard. The survey area contained relatively larger populations of goldeneyes and bufflehead compared to other interior Alaska wetlands. Coefficients of variation for population indices of abundant species ranged from 8-14%.

A computerized geographic information system (GIS) was used to map bird locations for most species. The highest concentrations of waterfowl occurred in the wetlands of the Minto Flats, Tetlin and Nowitna National Wildlife Refuges, and the Lake Minchumina area. Relatively fewer waterfowl were observed in the Tanana River valley between Tetlin and Delta Junction and near Sleetmute. Point location maps are presented for most species observed.

The aerial survey systematic design and GIS analyses provide detailed waterbird abundance and distribution information. Results can be compared to those from the North American Waterfowl Breeding Population Survey's Tanana/Kuskokwim Stratum to evaluate both designs and improve subsequent surveys to meet specific objectives. Maps can be used as data layers for further analyses such as creating stratified survey designs and examining relationships between remotely sensed habitat data and waterbird distribution.

INTRODUCTION

An aerial waterfowl breeding population survey was initiated in 1957 and has been conducted annually on the Tanana/Kuskokwim lowlands (Stratum 3) as part of the North American Waterfowl Breeding Population Survey (NAWBPS) (Conant and Groves 2002). The purpose of the NAWBPS is to provide population indices for use in developing waterfowl harvest regulations. Intensity of coverage on the Tanana/Kuskokwim stratum by this survey is limited since it is only one of 12 strata surveyed annually by one crew in Alaska and the Yukon Territory. On the Tanana/Kuskokwim stratum, the NAWBPS consists of 18 transects totaling 855 km. Transect placement was based on landmarks as aids in navigation to ease annual repeatability of the survey. Consequently, important habitats may not have been adequately sampled or conversely, could have been oversampled. Thus, non-random placement of transects may result in biased estimates of bird abundance. In addition, because NAWBPS data were traditionally recorded by 16-mile segments along each transect, these data provide limited information on waterbird distribution.

Within the last 12 years, several improvements and advancements in technology have been incorporated into designing and conducting aerial surveys and analyzing data in Alaska by Migratory Bird Management. We began by using a statistically valid standard survey design with systematically-spaced transects following suggestions of Caughley (1977). We developed a geographic information system consisting of custom True BASIC programs and ARC/INFO software that allowed us to generate a set of transects for any geographic area and plot them on topographic maps for use in the aircraft. Use of

a Global Positioning System (GPS), enabled us to accurately navigate systematic transects. In addition, Jack Hodges (Migratory Bird Management, Juneau) has developed a new data collection program using the GPS connected to laptop computers. Bird location data have been entered into the GIS allowing mapping of species locations as well as further analyses such as developing stratifications for population estimates or overlays with habitat information.

This system has been used on the Koyukuk/Kanuti area (Platte 1999a), Selawik area (Platte 1999b), Innoko area (Platte 1996), Bristol Bay region (Platte and Butler 1995), Yukon Flats National Wildlife Refuge (Platte and Butler 1992), Yukon Delta National Wildlife Refuge (Balogh and Butler 1994, Platte and Butler 1993), Copper River Delta (Butler and Eldridge 1991), the west coast of Alaska, and the arctic coastal plain of Alaska (Mallek et al. 2002, Larned et al. 2001). Improvements include increased precision in population indices, detailed distribution maps, and calculation of population indices on desired land parcels such as federal versus non-federal land.

The objectives for the expanded breeding population survey on the Tanana/Kuskokwim lowlands were as follows:

1. Estimate the abundance of waterbirds.
2. Map the distribution of waterbirds.
3. Compare the new survey design with the traditional design.

Comparison of the expanded survey results with those of the NAWBPS and development of an improved survey design will be addressed in a future report.

STUDY AREA

The Tanana/Kuskokwim lowlands survey area occupies about 52,797 km^2 of interior Alaska (Fig. 1) including portions of Tetlin and Nowitna National Wildlife Refuges, Denali National Park, and Fort Wainwright and Fort Greely Military Operational Areas. Most wetlands in this area occur in the floodplain valleys of the major rivers. In the northwestern portion of the survey area, the lowlands of the Nowitna Refuge contain about 14,000 small (less than 0.04 km^2) lakes and ponds, including numerous oxbows along the major rivers (U.S. Fish and Wildlife Service 1987a). Tetlin Refuge consists largely of lowland complexes of ponds, marshes, and bogs in the northern end (U.S. Fish and Wildlife Service 1987b).

The climate of the area is continental with high summer temperatures, averaging about 58-62° F in July (Lensink and Rothe 1986). Daytime temperatures can exceed 80° F. Precipitation is low with up to 11.2 inches in the Tanana Valley.

METHODS

Aerial Survey and Data CollectionTechniques

The traditional NAWBPS transects are shown in Figure 1. For the expanded breeding population survey, we used a True Basic program and ARC/INFO to generate systematically spaced transects from a random coordinate within the predetermined

survey area. Transects were oriented east west along great circle routes and totaled about 7,371 kms (Fig. 1). Systematic sampling was appropriate for the dual objectives of mapping distributions and estimating total numbers when accuracy of the estimate's standard error was not critical (Caughley 1977). We plotted transects on 1:250,000 scale topographic maps for use in the aircraft. One set of transects was flown in 2001 (every other designed transect) and the alternate set was flown in 2002. We combined data for both years resulting in a distance between transects of 7.4 km yielding a sample of 2,948 km^2 (5.6%) of the 52,797 km^2 survey area. In 2002, an additional set of transects was flown in between the planned transects on the Minto Flats area to gather additional information for potential resource development activities.

Survey methods followed the conventions established for breeding ground surveys in North America (USFWS and CWS 1987). The survey was flown May 21-25 in both 2001 and 2002 to coincide with egg-laying or early incubation stages of most species of breeding waterfowl. Two amphibious Cessna 206 aircraft were flown at 137 - 153 km Hr-1, 30 - 46 m of altitude, with wind speed < 24 km hr^{-1}, ceilings > 152 m and visibility > 16 km. The pilots used a global positioning system and the survey maps to maintain a precise course while flying transects. Two crews consisting of Ed Mallek (pilot-observer) and Alan Brackney (observer) and John Hodges (pilot-observer) and Julian Fischer (observer) flew the survey in 2001. In 2002, Dennis Marks replaced Alan Brackney as observer with Ed Mallek.

A data collection program called Global Positioning System Voice Survey written by John Hodges (Migratory Bird Management, USFWS, Juneau) was used for the expanded surveys. This system uses a notebook computer connected with a global positioning system (GPS) receiver and a remote microphone and mouse. The pilot and observer recorded transect numbers, start and stop points, cardinal direction of the start end of the transect, and bird observations directly into the computer to a .WAV format sound file using the remote microphone and mouse. Birds observed were identified to species and counted as a single, pair, or number in flock. Simultaneously latitude/longitude coordinates for each observation were automatically downloaded from the GPS to a text file. A data transcription program also written by John Hodges was used to replay the sound files, enter header information, species codes, group sizes and combine these with the coordinate information to produce a final data file.

Population estimates

We calculated densities, population estimates, and variability for each species using a ratio estimate described by Cochran (1977). Estimates were based on indicated total birds: 2*(S+P)+F where S = number of single birds observed, P = number of bird pairs observed, and F = number of birds in flocks. For ducks, a single male was assumed to represent a breeding pair with the nesting hen not easily observable. Single male ducks were doubled for all observed species except scaup and ring-necked duck. Single observations of other waterbird species (geese, swans, cranes, grebes, loons, terns, and gulls) were not doubled. Numbers of ducks were corrected for visibility bias using correction factors from Conant and Groves (1992). Visibility correction factors for other waterbird species are currently unknown. Population estimates were calculated as averages of the combined two years of data for the survey area divided into several large

geographic strata (Fig. 2). This stratified analysis was done to try to reduce the variance of the estimates.

Population estimate variance was based on the variation among sampling units (entire transects). The sample size, combining samples from 2001 and 2002, was 291 transects. The additional variance associated with visibility correction factors was not included in our calculations.

RESULTS AND DISCUSSION

Results from the 2001 survey were reported in Platte and Stehn (2002). The following results use the combined 2001-2002 survey data.

Population estimates

The average population estimate for ducks was 345,908 or 6.5 ducks/km^2. Northern pintails were the most abundant ducks with about 63,000 birds and a density of 1.2/km^2 (Table 1). American green-winged teal were next in abundance with about 55,000 birds. The average duck population consisted of 18% pintail, 16% green-winged teal, 14% scaup, 13% wigeon and mallards, and less than 10% each of goldeneyes, northern shovelers, bufflehead, scoters, canvasbacks, ring-necked ducks, long-tailed ducks, and mergansers. Coefficients of variation were lowest for the dabbling duck species except gadwall, ranging from 8 – 10%. Variability of population estimates was relatively high for the diving and seaduck species ranging from 12-82%.

The estimated average goose population of about 4,100 was comprised of 54% Canada geese and 46% white-fronted geese. We estimated an average of about 1,032 common loons and 949 Pacific loons on the survey area.

Average duck density on the survey area was relatively low compared to other survey areas in Alaska (Table 2). Duck densities were lower only in the Koyukuk/Kanuti areas. However, the Tanana/Kuskokwim lowlands contained relatively higher numbers of goldeneyes, bufflehead, and canvasbacks.

Waterbird distribution

More than 3,800 geographic locations of birds were obtained from the 2001-2002 surveys. Waterbird locations were mapped for the major species occurring on the survey area (Figs. 3-24). Waterbird distribution coincided with the patchy distribution of wetland complexes throughout the area. While most species were widely but sparsely distributed throughout the survey area, higher concentrations of waterfowl occurred on the Minto, Tetlin, and Nowitna wetlands and near Lake Minchumina. In particular, more waterbirds were observed in the Muddy River lakes complex northeast of Lake Minchumina, the western half of the Nowitna Refuge along the Nowitna River floodplain, the area immediately southeast of Tanana, and all of the Minto Flats and the Tetlin Refuge. Additionally, many of these areas had high diversity containing as many as 23 species of waterbirds.

Pintails, mallards, wigeon, and scaup were the most widely distributed species occurring over most of the survey area. Canvasbacks occurred mostly in the Minto Flats,

Nowitna NWR, and Tetlin NWR. Tetlin NWR and the Minto Flats contained most of the Pacific loon observations whereas common loons were more widely scattered.

The Tanana River Valley between Tetlin and Delta Junction was relative sparsely populated with waterbirds as was the lower Kuskokwim River area near Sleetmute, . Goldeneye and bufflehead distributions were similar although bufflehead observations were mostly absent in the southwest corner of the survey area south of McGrath. Geese were sparsely distributed in the western portion of the survey area with very few Canada geese and no white-fronted geese observed on the eastern half of the survey area from Fairbanks to Tetlin NWR.

RECOMMENDATIONS

Accurate waterbird abundance and distribution information over large geographic areas provides baseline information for management decision-making. The information can be used for land acquisition planning, mitigation planning, permit reviews, harvest regulation, and identification of unique ecological areas. Waterfowl distribution maps for many of the National Wildlife Refuges in Alaska have been incorporated into the Division of Realty Acquisition Priority System model for ranking private lands within refuges for acquisition.

Analyses will be conducted in the future to compare the results from this survey and the NAWBPS. This information is important for designing future surveys to meet specific objectives.

Migratory Bird Management has mapped waterbird distribution and abundance on many of the important wetlands in Alaska using the survey techniques and geographic information system developed. Only two areas remain that have not been intensively surveyed, the Kenai/Susitna basin and the Nelchina basin. We recommend that expanded surveys be conducted in these areas to contribute to a standardized waterbird database for the State of Alaska.

ACKNOWLEDGMENTS

We thank pilot/biologists J. Hodges (USFWS, Migratory Bird Management, Juneau), and Ed Mallek (USFWS, Migratory Bird Management, Fairbanks) and biologists A. Brackney (USFWS, Arctic National Wildlife Refuge, Fairbanks), J. Fischer and D. Marks (both at USFWS, Migratory Bird Management, Anchorage) for conducting the surveys. Special thanks to R. Stehn (USFWS, Migratory Bird Management, Anchorage) for programming and statistical analysis.

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Table 1. Average densities, population indices, and variances of species observed on May 21-25, 2001 and 2002 aerial surveys of the Tanana/Kuskokwim lowlands, Alaska

Species	Measure (1)	Density (per sq. km)	Standard Error of density	Population Index (2)	Std. Error Pop. Index	Coefficient of variation	95% Confidence Interval	Visibility Correction factor	Visibility-Corrected index
Canada goose	12	0.04	0.012	2091	616	0.295	1207		
White-fronted goose	12	0.034	0.011	1802	580	0.322	1136		
Snow goose	12	0.004	0.003	205	157	0.766	308		
Swan spp.	12	0.098	0.008	5195	444	0.085	870		
Sandhill crane	12	0.015	0.004	804	196	0.244	385		
Red-throated loon	12	0.001	0	38	26	0.684	51		
Pacific loon	12	0.018	0.004	949	216	0.227	423		
Common loon	12	0.02	0.004	1032	191	0.185	374		
Mallard	13	0.23	0.018	12121	969	0.08	1898	3.57	43272
Gadwall	13	0.001	0.001	38	39	1.018	76	3.04	116
American wigeon	13	0.24	0.021	12691	1123	0.088	2201	3.65	46322
American green-winged teal	13	0.118	0.011	6248	580	0.093	1136	8.88	55482
Northern shoveler	13	0.107	0.014	5660	756	0.134	1482	3.35	18961
Northern pintail	13	0.473	0.047	24996	2460	0.098	4821	2.51	62740
Redhead	12	0.001	0.001	75	52	0.691	102	3.11	233
Canvasback	13	0.037	0.008	1955	402	0.205	787	2.43	4751
Scaup	12	0.513	0.074	27099	3895	0.144	7635	1.82	49320
Ring-necked duck	12	0.012	0.003	647	158	0.244	309	4.02	2601
Goldeneye spp.	13	0.16	0.023	8472	1204	0.142	2360	3.61	30584
Bufflehead	13	0.171	0.02	9024	1064	0.118	2086	1.86	16785
Long-tailed duck	13	0.023	0.013	1223	703	0.575	1378	1.99	2434
Black scoter	13	0.003	0.003	171	139	0.818	273	1.08	185
Unidentified scoter	13	0.037	0.013	1937	667	0.344	1307	1.08	2092
White-winged scoter	13	0.098	0.033	5188	1731	0.334	3392	1.08	5603
Surf Scoter	13	0.052	0.013	2731	696	0.255	1364	1.08	2949
Red-breasted merganser	13	0.018	0.004	931	236	0.253	462	1.27	1182
Common merganser	13	0.004	0.002	233	98	0.424	193	1.27	296
Red-necked grebe	12	0.023	0.004	1197	214	0.179	419		
Glaucous gull	12	0.009	0.003	474	146	0.307	286		
Mew gull	12	0.085	0.017	4481	913	0.204	1789		
Sabine's gull	12	0.002	0.001	103	53	0.511	103		
Arctic tern	12	0.04	0.01	2092	553	0.264	1083		

(1) Measure 12: Total birds = singles + (2 x pairs) + birds in flocks
Measure 13: Indicated total birds = 2 x (singles + pairs) + birds in flocks

(2) Population index = Density x Survey area, Survey area = 52,797 sq. km.

Table 2. Comparison of densities[1] (per sq. km) for selected species and total ducks from spring aerial surveys on 9 survey areas in Alaska. Boxes denote highest density for each species and total ducks.

	Survey Area								
Species or group	Yukon Delta NWR[2]	Yukon Flats NWR[3]	Arctic coastal plain[4]	Bristol Bay region[5]	southern unit Innoko NWR[6]	northern unit Innoko NWR and Yukon River wetlands[7]	Selawik NWR and Noatak Lowlands[8]	Koyukuk and Kanuti NWRs[9]	Tanana and Kuskokwim Lowlands[10]
Northern pintail	**4.7**	3.0	3.4	1.1	3.1	1.7	4.6	0.5	1.2
Mallard	1.0	**3.4**	0.5	0.9	0.5	1.7	1.3	0.4	0.8
Green-winged teal	1.9	1.8	0.1	1.0	2.3	**3.7**	1.9	0.3	1.1
American wigeon	1.1	3.1	0.1	0.4	1.8	3.2	**5.7**	0.9	0.9
Northern shoveler	1.3	**2.5**	--	0.3	1.1	1.5	1.3	0.4	0.4
Canvasback	0.1	**1.5**	--	--	--	0.1	--	--	0.1
Scaup	2.8	**6.1**	0.4	1.9	1.3	1.2	4.0	1.3	0.9
Long-tailed duck	0.5	0.1	**1.5**	0.1	--	--	0.6	0.1	0.1
Scoter	1.2	**1.9**	0.2	1.0	0.5	0.1	0.9	0.2	0.2
Goldeneye	0.2	0.4	--	0.3	0.3	**0.7**	--	0.1	0.6
Bufflehead	--	**0.4**	--	--	0.1	0.3	--	0.2	0.3
Total ducks	14.8	**24.2**	6.2	7.0	11.0	14.2	20.3	4.4	6.6

[1] Densities are based on indicated total birds (except for scaup) corrected for visibility bias and calculated as average of mean annual densities.
[2] Surveys from 1989-1992
[3] Surveys from 1989-1991
[4] Surveys from 1986-1990
[5] Surveys from 1993-1994
[6] Survey in 1994
[7] Survey in 1995
[8] Surveys from 1996-1997
[9] Surveys from 1996-1997
[10] Surveys from 2001-2002

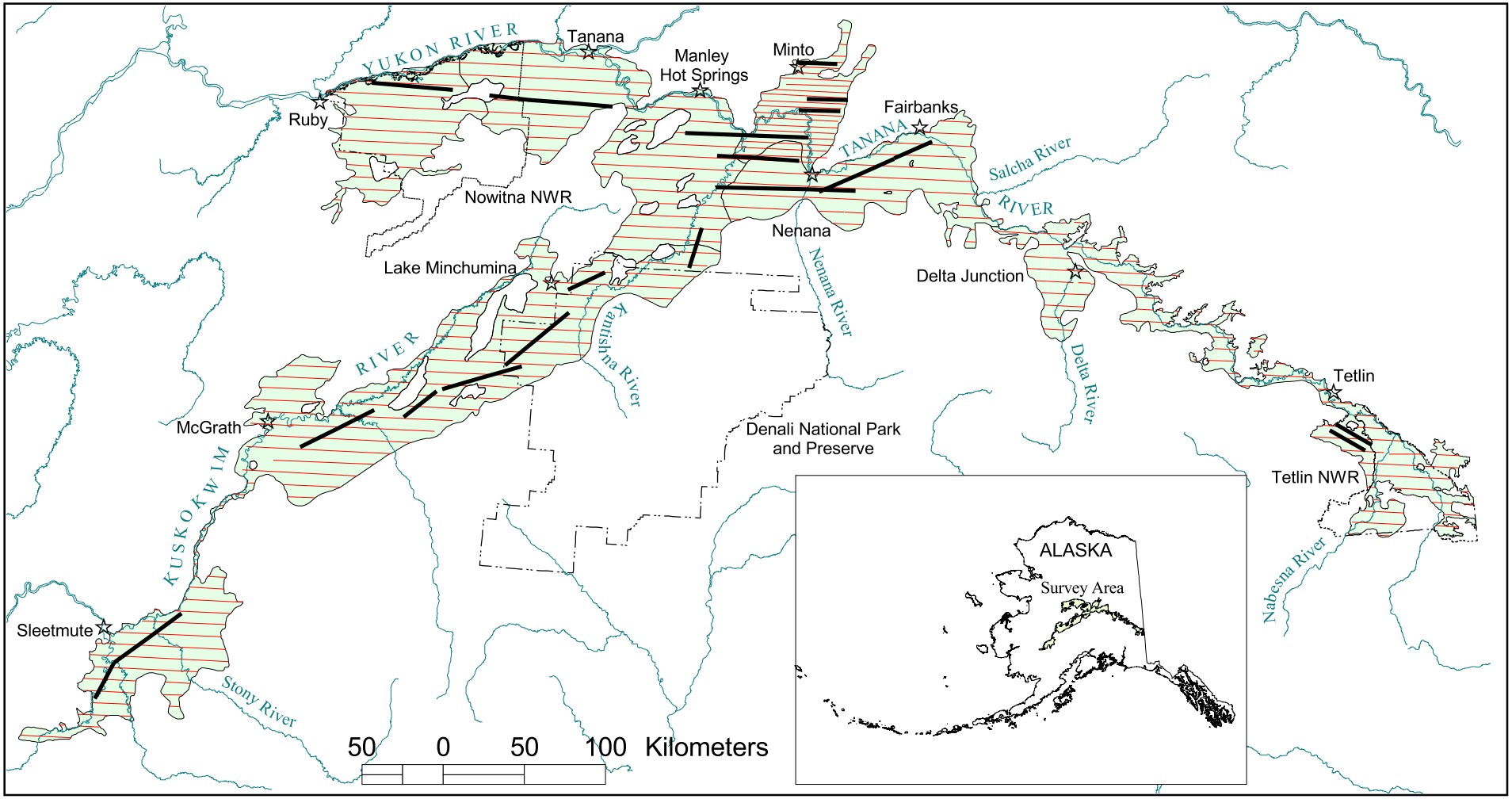

Fig. 1. Location of the expanded breeding waterbird survey area and transects (thin east-west lines) relative to the traditional NAWBPS transects (thick lines) on the Tanana/Kuskokwim lowlands, Alaska.